MANITOBA Pulse Soybean GROWERS

Lupin Production Guidelines

Lupins are an attractive alternative pulse crop option since they are good nitrogen (N) fixers, resistant to Aphanomyces root rot and have an upright growth habit with good standability.

Lupin markets are in development in western Canada. They are rich in protein (35-40% protein), high in fibre (~25%), and low in oil (2–8%) and starch (~2%), making them an attractive option for protein fractionators.[1]

FIELD SELECTION

Moisture

Lupins have moderate to high moisture requirements, needing at least nine inches (225 mm) of water over the growing season.[2] Sandy soils are not well suited to lupins since they do not hold water well. In heavy clay soils, compaction or crusting can reduce emergence since lupin cotyledons are brought above ground like soybean and dry bean cotyledons.

Lupin cotyledons are brought above ground at emergence, like soybeans and dry beans.

Iron Deficiency Chlorosis (IDC) and pH

Lupins grown in soils with high calcium carbonates, moisture and soluble salt levels are susceptible to IDC. Lupins tolerate acidic to mildly alkaline and slightly calcareous soils, and pH tolerance varies with lupin species. Broadleaved sweet white lupins tolerate pH up to 7.8 while narrow-leaved blue lupins tolerate pH up to 7.2.[2] Choose fields with organic matter >4% to maximize in-crop herbicide options.

Crop Rotation

Cereal crops (wheat, oats, barley) are preferred stubble types to precede lupin production since there are no herbicide options to control volunteer canola in-crop. Following cereal crops also provides an opportunity to control perennial weeds ahead of growing lupins.

Similar to peas, lupins are sensitive to damage from select soil residual herbicides like sulfonylureas, clopyralid, dicamba and pyrasulfatole. Refer to the *Guide to Crop Protection* for a full list of recropping intervals.

VARIETY SELECTION

There are four lupin species of agricultural significance and crop management of these species can be quite different. To date, limited commercial production in Manitoba has been of the broadleaved sweet white lupin (*Lupinus albus*). Regional variety testing of this crop in Manitoba has also explored narrow-leaved blue lupins (*L. angustifolius*) and more recently, yellow lupins *(L. luteus*).

Broadleaved Sweet White Lupin

White lupins are long-season (130 days to maturity) and have an indeterminate growth habit. They form branches and grow taller (70–80 cm). The seed size of this lupin type is large (350–425 g/1000 seeds) and flat in shape. Flowering occurs in stages, with the first inflorescence developing on the main stem, followed by second and often third inflorescences on subsequent branches.

Narrow-Leaved Blue Lupin

Narrow-leaved lupins are short-season (110 days to maturity) with a determinate growth habit growing to 50–60 cm heights. Seed size is smaller (175–225 g/1000 seeds) and oval to round in shape.

Broadleaved sweet white lupins (L) and narrow-leaved blue lupins (R) are as different from each other as wheat is to oats.[2]

Lupins require 110–130 frost-free days from planting to maturity, depending on type and variety. See MPSG's *Pulse and Soybean Variety Guide* for local lupin variety data such as days to maturity and yield.

SEEDING

Seeding Date

Plant lupins within the first week of May to maximize yield and ensure white lupins mature before fall frosts. After the cotyledon stage, lupins have good spring frost tolerance.[3]

Like peas and faba beans, high temperatures during flowering may cause flower blasting where flowers abort.[3]

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Target Plant Stand and Seeding Rate

Target plant stands vary with lupin type. For broadleaved sweet white lupins, target a living plant stand of 5 plants/ft^2 (218,000 plants/ac) and for narrow-leaved lupins, target 10 plants/ft^2 (435,000 plants/ac).[2]

Seeding Depth

Seed lupins into moisture at a depth of at least one inch. Since lupin cotyledons are brought above ground like soybeans, they cannot tolerate seed depths deeper than two inches. Ensure even crop residue distribution across the field to aid ease of emergence.

Rolling

Rolling is not generally required for lupins since they typically do not lodge under normal growing conditions and pod high off the ground.

CROP NUTRITION

Inoculant

Inoculate lupins with *Bradyrhizobium lupini* bacteria to facilitate root nodule development and biological N fixation.[3] This rhizobia inoculant is specific to lupins and currently available in liquid and peat formulations. Lupins fix around 65–78% of their N requirements.[4, 5]

Fertility

Select fields with <50 lbs N/ac of residual N to facilitate nodule development. No additional N fertilizer is required.

Balance phosphorus (P) and potassium (K) removal with inputs throughout the crop rotation, maintaining soil test P levels of 10–20 ppm and K levels >100 ppm.

Since lupins are seeded into cool soils, access to P early in the season will promote root development and early-season growth. Research from Alberta indicates that applying 20 lbs P_2O_5/ha, (35 lbs/ac of 11-51-0 side banded – one inch to the side) maximizes yield and minimizes risk.[2]

PEST MANAGEMENT

Insects

Monitor for wireworms and cutworms from May to June. Insecticide seed treatments are available to protect against wireworms. Assess the need to use these products on a field-by-field basis.

Blister beetles (*Epicauta* spp. and *Lytta* spp.) will preferentially feed on lupins. They may cause defoliation and have also been observed to feed on the flower buds and young pods.

Scout for grasshoppers from June to August, ensuring defoliation remains low. Defoliation thresholds do not exist for lupins, but metre-square estimates of grasshopper numbers may be used. Estimate the number of grasshoppers that jump from a square metre area as you walk toward it and then count the remaining grasshoppers in the area by disturbing plants to encourage them to jump. Repeat this at least five times to establish an estimate for the area and do not walk in a straight line so jumping grasshoppers do not accumulate on your path. Control is usually warranted when populations exceed 8–12 grasshoppers per square metre.[6]

Weeds

Select relatively weed-free fields where perennial weeds have been managed in the previous crop. Note that no in-crop herbicide options will control volunteer canola, so seeding into canola stubble should be avoided.

Weed control options are relatively limited for this emerging crop. Several user-requested minor use label expansions (URMULEs) are in progress to expand herbicide options for lupins. Refer to Health Canada's *Consumer Product Safety Database* for a full list of current products registered for use on lupin by typing lupin, lupins, lupine, lupines into the search tab to search full contents of e-labels.

Volunteer canola in a field of lupins. Avoid seeding lupins into canola stubble, since there are no in-crop herbicide options to manage volunteer canola.

Crop injury can occur from common pulse herbicides like *Viper* (imazamox and bentazon), *Odyssey* (imazamox and imazethapyr), *Pursuit* (imazethapyr) or *Basagran* (bentazon), among others, so read product labels closely before applying to lupins.

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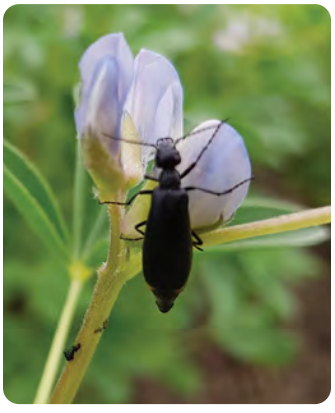

Black (left) and grey (centre) *Epicauta* blister beetles and Nutall's blister beetle (right) preferentially feed on lupins.

Fall-applied *Edge* (ethalfluralin) has shown more consistent weed control for lupins than spring applications.[2] Using a pre-seeding burndown combined with timely in-crop applications is recommended.

Diseases

Lupins are resistant to *Aphanomyces euteiches*, making them an attractive alternative pulse crop option in fields with this root rot disease.

Lupins are susceptible to root rot complexes, including *Fusarium* spp., *Pythium* spp. and *Rhizoctonia* solani. Fungicide seed treatments can offer protection from these diseases up to three weeks after planting. Consider fungicide seed treatments when planting in short rotations with other pulse crops or when soil conditions are saturated.

Photo: Mark Olson, Lupin Platform Inc.

Anthracnose in broadleaved white lupins causes shepherds hook-like twisting at the top of the plant.

Scout for foliar and stem diseases from July to early September. The main yield-limiting disease of concern is Anthracnose (*Collectotrichum gloeosporiodes* or *C. acutatum*) when weather conditions are conducive to its development. Broadleaved white lupins and yellow lupins are more susceptible to anthracnose than narrow-leaved blue lupins. Like other broadleaved crops, lupins are susceptible to white mould (Sclerotinia).

HARVEST

Direct harvest (straight cutting) is most common for lupins. White lupins typically do not shatter at harvest, while narrow-leaved blue lupins are susceptible to shatter losses and should be monitored closely during maturity and harvest. Harvesting at higher seed moisture contents is recommended to avoid shatter in narrow-leaved blue lupins, followed by aeration to dry down to safe storage levels.

Long-season, indeterminate white lupins typically require a desiccant to advance harvest. At desiccation timing, pods at the bottom of the plant will be ripe and seeds within those pods will have detached from pods. Seeds within pods at the upper portion of the plant will split evenly in half, not squish, when pressure is applied. At this stage, plant stalks may be green.[2]

Lupins are ready for harvest at 7–18% seed moisture, around 7–10 days after desiccation. Aeration following harvest is common to bring lupins down to the safe storage moisture of 15%.[3]

References

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[2] Olson, M., Lupin Platform Inc. Lupin Production – Quick Tips.

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[4] Larsen, K.J., K.G. Cassman and D.A. Phillips. 1989. Yield, dinitrogen fixation and aboveground nitrogen balance of irrigated white lupin in a mediterranean climate. Agron. J. 81:30 *doi.org/10.2134/agronj1989.00021962008100030029x*

[5] Kelstrup, L., J.S. Rowarth, P.H. Williams and C. Ronson. 1996. Nitrogen fixation in peas (*Pisum sativum*), lupins (*Lupinus angustifolius* L.) and lentils (*Lens culinaris* Medik). Proceedings Agronomy Society of NZ. 26.

[6] Gavloski, J. 2022. Grasshoppers: Identification, Monitoring and Management. *https://www.gov.mb.ca/agriculture/crops/insects/pubs/grasshoppers-factsheet-revised-november2022.pdf*